

## Proximity Navigation Near and Mapping of Asteroids

Completed Technology Project (2013 - 2017)



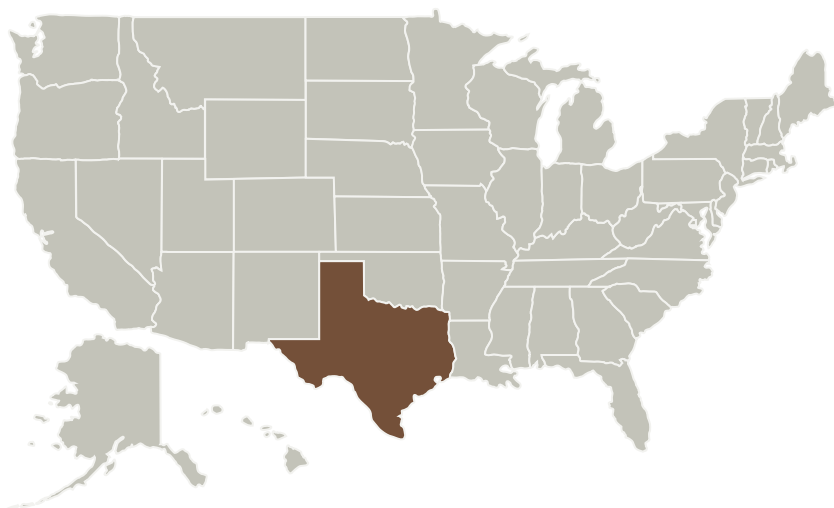
## Project Introduction

Sensor fusion algorithms are proposed that enable proximity navigation and mapping of an unknown space object, such as an asteroid. The sensors envisioned are a range sensor (Flash LIDAR), and a synchronized and co-registered HD video camera, and an IMU. The transition from intermediate to close proximity is considered wherein the observability early-on allows only the 3DOF range vector to be determined, and in close proximity where the full 6DOF relative pose is observable and the object geometry can be recursively learned/estimated. Our algorithms are novel because of (i) unique utilization of sensor field overlap-induced information redundancy to eliminate poor features and retain the most consistent features on the object based on statistical hypothesis-testing and (ii) utilization of a recently discovered way to rigorously linearize the least square fusion of two overlapping point clouds, without approximation. End-to-end experiments in our laboratory <http://lasr.tamu.edu/> are proposed to accelerate maturation and evaluation of the technology.

## Anticipated Benefits

Our algorithms are novel because of (i) unique utilization of sensor field overlap-induced information redundancy to eliminate poor features and retain the most consistent features on the object based on statistical hypothesis-testing and (ii) utilization of a recently discovered way to rigorously linearize the least square fusion of two overlapping point clouds, without approximation.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Responsible Program:

Space Technology Research Grants

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Organizations Performing Work	Role	Type	Location
Texas A & M University-College Station(Texas A&M)	Supporting Organization	Academia Hispanic Serving Institutions (HSI)	College Station, Texas

## Primary U.S. Work Locations

Texas

## Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

## Project Management

## Program Director:

Claudia M Meyer

## Program Manager:

Hung D Nguyen

## Principal Investigator:

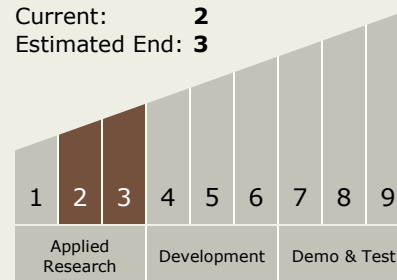
John Junkins

## Co-Investigator:

Dylan T Conway

## Technology Maturity (TRL)

Start: 2  
Current: 2  
Estimated End: 3



## Technology Areas

## Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.5 Rendezvous, Proximity Operations, and Capture Sensor Processing and Processors